EXHIBIT A

Poultry Waste Generation and Land Application in the Illinois River Watershed and Phosphorus Loads to the Illinois River Watershed Streams and Rivers and Lake Tenkiller

Expert Report of Dr. B. Engel

For
State of Oklahoma
In Case No. 05-CU-329-GKF-SAJ

State of Oklahoma v. Tyson Foods, et al.
(In the United States District Court for the Northern District of Oklahoma)

Dr. B. Engel, P.E.
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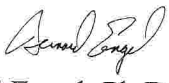
May 22, 2008



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Appendices

6. Point Sources of P in the Illinois River Watershed

A portion of the P in the IRW rivers and streams and reaching Lake Tenkiller is from Waste Water Treatment Plant (WWTP) discharges. Waste Water Treatment Plants within the IRW discharge P into the streams and rivers of the IRW that eventually reaches Lake Tenkiller. ***P discharges from IRW WWTP have changed over time. WWTP P discharges into IRW streams and rivers peaked at slightly more than 204,000 lbs annually in the late 1990s and early 2000s. Beginning in 2003, WWTP P discharges decreased to a little more than 90,000 lbs annually in the IRW due to changes in WWTP technology. The defendants' processing facilities discharge a significant amount of P to WWTPs and thus contribute to point P sources within the IRW.***

WWTP contributions of P to the Illinois River for three time periods are shown in Table 6.1. Changes in WWTP technology significantly reduced P contributions beginning in 2003 (from more than 204,000 lbs annually to a little more than 90,000 lbs annually). Recent P discharges from WWTPs were computed from recent WWTP discharge data (1999-2007 Permit Compliance System (PCS) data) from the Oklahoma Department of Environmental Quality and the Arkansas Department of Environmental Quality. WWTP discharges prior to 2003 were obtained from Gade (1998), representing P discharges for the 1990s through 2002. Nelson reported similar WWTP discharges of P for the Arkansas portion of the Illinois River for the late 1990s through 2006. Nelson observed a significant reduction in WWTP P discharges beginning in 2003. Discharges from Arkansas WWTPs represent the majority of WWTP P discharges into the IRW streams and rivers.

Table 6.1. WWTP Total P Discharge to Streams and Rivers within the IRW

	Mid 70s	**Early 90s**	**2003-present**
WWTP	**P Load (lb/yr)**	**P Load (lb/yr)**	**P Load (lb/yr)**
Springdale	70,841	95,128	25,112
Siloam Springs	23,014	22,046	29,638
Fayetteville - Noland	0	9,921	5,147
Rogers	41,515	47,619	16,206
Lincoln	1,767	2,646	2,336
Prairie Grove	2,409	2,646	3,285
Tahlequah	19,235	10,362	2,738
Stillwell	15,675		2,519
Westville	2,502	6,393	840
Gentry	1,767	3,748	2,336
Watts		1,102	0
Midwestern nursery		1,323	0
Cherokee Nation Stillwell Cannery		1,168	0
Total	**178,724**	**204,101**	**90,155**

The WWTP P discharges from the late 1970s and early 80s were obtained from the Roberts/Schnorick and Associates report of 1984 and two EPA Environmental Lab (1977)

reports as shown in Table 6.2. The Roberts/Schnorick report provides WWTP discharges for 1979-1984 and the EPA values are mid 1970s values. The Roberts/Schnorick P discharge values are reported as lbs/day of phosphorus. Comparing Roberts/Schnorick P discharges for the same WWTPs with the EPA values and values reported for later in the 1980s, the Roberts/Schnorick P discharges are not phosphorus but are phosphate (P_2O_5). The discharges converted to P are shown in the far right column in Table 6.2.

Table 6.2. WWTP P Discharges into IRW Streams and Rivers for Late 1970s and Early 1980s

	Annual P Discharge (lbs/yr)		
WWTP	**Roberts/Schnorick (1984) as P_2O_5**	**Environmental Lab Las Vegas (1977)**	**Roberts/Schnorick as P**
Springdale	161,002		70,841
Siloam Springs	52,305		23,014
Fayetteville - Noland	0		0
Rogers	94,353		41,515
Lincoln	4,015	1,312	1,767
Prairie Grove	5,475		2,409
Tahlequah	46,173	19,235	20,316
Stillwell	0	15,675	0
Westville	0	2,502	0
Gentry	4,015		1,767

The Roberts/Schnorick report indicates there were three permitted point source discharges in the upper Illinois River system in addition to the WWTPs they considered. These were the Centerton Hatchery, the Swepco Flint Creek Power Plant and Gates Rubber. No P discharges from these sources were reported (permits did not include P discharge) or considered in the Roberts/Schnorick Illinois River assessment report.

The historical WWTP P discharges into streams and rivers of the IRW are shown in Table 6.3. These were needed for modeling P Loads (Section 10). The late 1970s/early 1980s WWTP P discharges shown in Table 6.2 were used to compute a waste discharge per person and the resulting value was used to compute WWTP P discharges for 1950, 1960 and 1970. WWTP P discharges from Table 6.1 were used for 1980 to present.

Table 6.3. Estimated WWTP P Discharges Historically into Streams and Rivers of the IRW

Year	**IRW population**	**Estimated P (kg/yr)**	**Estimated P (lb/yr)**	**Observed P (lb/yr)**
1950	83,874	46,701	102,958	
1960	91,552	50,977	112,383	
1970	125,496	69,877	154,050	
1980	165,695			178,724
1990	192,439			204,101
2000	280,383			90,155

A substantial amount of the P discharged from the Springdale WWTP is from industrial sources. Table 6.4 shows industrial P flows to the Springdale WWTP. The defendants discharge more than 88% of the industrial P to the Springdale WWTP (more than 257,000 lbs annually). Historically (before 2003), the Springdale WWTP P discharges were 44% of IRW WWTP P discharges and currently (since 2003) represent about 28% of IRW WWTP P discharges.

Table 6.4. P Discharges to Springdale WWTP from Industrial Sources

Facility Name	**Dates**	**P (lb/d)**
Allen Canning Co	10/87-12/90	11.8
Allen Canning Co	12/94-11/01	80.8
Blaylock Company	12/94-11/02	2.8
Cargill, Inc.	**12/94-11/03**	**118.8**
Cintas Corporation	12/94-11/03	7.6
D. B. Foods, Inc	12/94-11/01	17.4
Danaher Tool Group	10/91-9/07	29.7
Danaher Tool Group	10/87-9/91	6.7
George's Debone	**2/97-11/01**	**30.5**
George's Further Processing	**12/02-11/03**	**52.0**
George's, Inc.	**12/94-11/03**	**115.5**
J. B. Hunt Transport, Inc	12/94-11/03	0.9
J. B. Hunt Transport, Inc	12/94-11/03	0.4
Monark Egg	10/87-9/90	12.2
Midcentral Egg	10/90-9/91	6.4
Pappas Foods, L.L.C.	12/00-11/01	4.1
Sonstegard Foods Inc. of Arkansas	12/02-11/03	0.0
Superior Linen Service	7/98-11/03	3.1
Triple T Foods, Inc.	12/94-11/03	3.9
Tyson Foods, Inc. - Berry St.	**12/94-11/03**	**244.0**
Tyson Foods, Inc. - Hog Trailer Wash	**8/95-11/03**	**14.5**
Tyson Foods, Inc. - Randall Rd.	**12/94-11/03**	**123.8**
Tyson Research & Technology	**10/95-11/03**	**6.1**
Total		893.0

The defendants make a substantial contribution to point source P discharges from the Springdale WWTP. The daily P contribution to the Springdale WWTP from people is approximately 138 lbs/day (2000 census population of Springdale is 45,798 people * 1.1 lb P/person per year / 365 days/yr). The defendants discharge 705 lbs P per day to the Springdale WWTP representing 79% of P inflow to the Springdale WWTP. Based on these inflows to the Springdale WWTP, the defendants' P discharge from the Springdale WWTP represents 35% of total WWTP P discharges into IRW rivers and Lake Tenkiller historically (44% of WWTP P from Springdale * 79% of P to Springdale from defendants = 35%) (before 2003) and currently (since 2003)

represents more than 22% of total WWTP P discharges to IRW rivers and Lake Tenkiller (28 % * 79% = 22%). The defendants' portion of P discharges through the Springdale WWTP represents a substantial amount of WWTP P discharges into IRW rivers and Lake Tenkiller.

WWTP water discharges to the IRW streams and rivers since 2003 are shown in Table 6.5 as reported in the PCS data.

Table 6.5. WWTP Water Discharges Since 2003

WWTP	Flow (mgd)
Springdale	12.4
Siloam Springs	2.68
Fayetteville - Noland	5.18
Rogers	5.71
Lincoln	0.44
Prairie Grove	0.32
Tahlequah	2.65
Stillwell	0.81
Westville	0.14
Gentry	0.44